In the United States Court of Federal Claims

OFFICE OF SPECIAL MASTERS

Filed: December 21, 2018

JESSICA JONES,	*	No. 15-1239V
Petitioner,	*	Special Master Sanders
v.	*	
SECRETARY OF HEALTH AND HUMAN SERVICES,	*	Entitlement; Tetanus-Diphtheria-acellular-Pertussis ("TDaP") Vaccine; Varicella Vaccine; Meningococcal Vaccine; Influenza ("flu") Vaccine; Small Fiber Neuropathy
Respondent.	*	

Clifford J. Shoemaker, Shoemaker, Gentry & Knickelbein, Vienna, VA, for Petitioner.
Adriana R. Teitel, United States Department of Justice, Washington, DC, for Respondent.

DECISION[1]

On October 23, 2015, Jessica Jones ("Petitioner") filed a petition pursuant to the National Vaccine Injury Compensation Program,[2] 42 U.S.C. §§ 300aa-10 to -34 (2012). Petitioner alleged that the Tetanus-Diphtheria-acellular-Pertussis ("TDaP"), Varicella, Meningococcal, and influenza ("flu") vaccines she received on November 10, 2012, caused her to develop small fiber neuropathy.[3] Am. Pet., ECF No. 26.

The undersigned held an entitlement hearing in this matter on May 3, 2018, in Washington, D.C. After considering the record as a whole, and for the reasons explained below, the undersigned finds that Petitioner failed to show that her condition was caused by the alleged vaccines and is therefore not entitled to compensation under the Vaccine Act.

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[1] This decision shall be posted on the United States Court of Federal Claims' website, in accordance with the E-Government Act of 2002, 44 U.S.C. § 3501 note (2012) (Federal Management and Promotion of Electronic Government Services). This means the Decision will be available to anyone with access to the Internet. In accordance with Vaccine Rule 18(b), a party has 14 days to identify and move to delete medical or other information that satisfies the criteria in § 300aa-12(d)(4)(B). Further, consistent with the rule requirement, a motion for redaction must include a proposed redacted decision. If, upon review, the undersigned agrees that the identified material fits within the requirements of that provision, such material will be deleted from public access.

[2] National Childhood Vaccine Injury Act of 1986, Pub L. No. 99-660, 100 Stat. 3755 ("the Vaccine Act" or "Act"). Hereinafter, for ease of citation, all "§" references to the Vaccine Act will be to the pertinent subparagraph of 42 U.S.C. § 300aa (2012).

[3] Petitioner's initial petition originally alleged several symptoms along with small fiber neuropathy. *See* ECF No. 1. Petitioner submitted an amended petition on August 17, 2016, wherein she specified small fiber neuropathy as her sole injury. ECF No. 26.

I. Procedural History

Petitioner submitted medical records over the months following her petition. ECF Nos. 6–14. On February 16, 2016, Respondent submitted his Rule 4(c) Report wherein he argued that Petitioner failed to provide a medical theory of causation sufficient to show entitlement for her claim. ECF No. 15. On August 17, 2016, Petitioner filed the expert report of Dr. Carlo Tornatore, one of Petitioner's treating physicians. ECF Nos. 25–26. Petitioner submitted Dr. Tornatore's first supplemental expert report on September 24, 2016.[4] ECF No. 28. On December 21, 2016, Respondent submitted a responsive expert report authored by Dr. Thomas Leist. ECF No. 30.

On January 11, 2017, this case was transferred to the undersigned.[5] ECF No. 32. Petitioner filed a second supplemental expert report on April 24, 2017. ECF No. 34. After Respondent indicated that he did not wish to submit another responsive report, the undersigned scheduled a hearing for May 3, 2018, in Washington, D.C. ECF Nos. 35, 38. During the hearing, Petitioner did not present a rebuttal argument and later filed a status report indicating that she "d[oes] not intend to offer any further evidence in rebuttal . . . ." ECF No. 61.

This matter is now ripe for a decision.

II. Medical Background

Prior to Petitioner receiving the vaccine at issue in this case, she suffered from two concussions. First, in 2008, Petitioner was thrown from a horse. Pet'r's Ex. 1 at 407, ECF No. 6-2. Petitioner was not wearing a helmet and hit the back of her head on the ground, causing her to lose consciousness. *Id.* at 437. Second, on May 23, 2009, Petitioner struck the back of her head while riding a rollercoaster. Pet'r's Ex. 15 at 4–5, ECF No. 18-2. Three days later, Petitioner presented to the Carthage Area Hospital emergency department with dizziness and persistent pain in the back of her head. *Id.* at 4. CT scans for both Petitioner's head and spine were normal. *Id.* at 11–12. Petitioner was diagnosed with a concussion and discharged that same day. *Id.* at 14–15.

Petitioner's head pain did not abate, and on September 10, 2009, she presented to the Samaritan Medical Center emergency department with severe headaches. Pet'r's Ex. 18 at 10, ECF No. 22-3. A CT scan was normal, and Petitioner was diagnosed with chronic headache. *Id.* at 11, 16. Two days later, Petitioner returned to the same emergency department after passing out at work. *Id.* at 34. Petitioner reported that her headache was then an eight out of ten on the pain scale. *Id.* Heart rate readings from that date showed that Petitioner had a heart rate of one-hundred-and-two beats per minute standing, and sixty-nine beats per minute lying down and sitting up. Pet'r's Ex. 16 at 7. Petitioner was diagnosed with chronic headache and syncope, and

[4] Petitioner's second report was written specifically to answer two questions from Special Master Hamilton-Fieldman. ECF No. 27. The undersigned considered this report as part of the record; however, as the report does not address Petitioner's causation theory or any other contested aspects of the case, the undersigned will not discuss it in this decision.

[5] This case was originally assigned to Special Master Hamilton-Fieldman. ECF No. 4.

discharged home. Pet'r's Ex. 18 at 40. On September 28, 2009, Petitioner had a follow-up appointment for her head injury where she also complained of irregular menses. Pet'r's Ex. 1 at 433.

Petitioner continued to suffer from headaches and developed photophobia[6] in the beginning of 2010. Pet'r's Ex. 1 at 424, 426. On January 11, 2010, Petitioner's mother requested a doctor's note permitting Petitioner to wear sunglasses in school due to light sensitivity. *Id.* at 426. On March 11, 2010, Petitioner visited the Walter Reed Army Medical Center's pediatric neurology clinic for treatment of chronic headaches that began since her injury on the rollercoaster. Pet'r's Ex. 1 at 418. Petitioner complained that she had been experiencing daily headaches "that [were] made worse by light, noise[,] and touching the back of her head." *Id.* Petitioner was prescribed a five-day course of steroids and a sleep aid. *Id.* at 421. On August 17, 2010, Petitioner presented to her doctor and complained of "six weeks of abdominal pain" described as "burning . . . then crampy." Pet'r's Ex. 4 at 2. Her physician suspected irritable bowel syndrome and ordered labs. *Id.* at 2–3. Petitioner continued to suffer from daily headaches through 2010 and 2011. Pet'r's Ex. 1 at 376–416.

On September 27, 2011, Petitioner's mother called the Family Health Center Woodbridge to ask for a doctor's note to allow Petitioner to forego wearing goggles in lab class because of the heavy pressure to the back of her head. Pet'r's Ex. 1 at 354. Petitioner's mother reiterated this request on October 11, 2011, explaining that the lab goggles "put too much pressure on [Petitioner's] head[,] [causing] excruciating pain and [Petitioner to] almost pass[] out." *Id.* at 353.

On November 10, 2012, Petitioner underwent a college physical where she received the TDaP, meningococcal, varicella, and flu vaccines at issue in this case. Pet'r's Ex. 1 at 303, 304. On January 16, 2013, Petitioner began receiving chiropractic care from Dr. Diane Alexander to treat "discomfort and[/]or paresthesia" in her back. Pet'r's Ex. 6 at 46, ECF No. 6–7. Petitioner received chiropractic care through December of 2015. *See generally* Pet'r's Ex. 6.

On January 17, 2013, Petitioner visited Dr. Robert MacDonnell for occupational therapy. Pet'r's Ex. 1 at 297. Petitioner said that she "was doing pretty good until yesterday morning[,] when [she] woke up with a headache that spread down [her] spine into [her] arms, pelvis and legs." *Id.* Despite treatment from Dr. MacDonnell, Petitioner's pain progressed. *Id.*; Pet'r's Ex. 5 at 5, ECF No. 6-6. Later that day, Petitioner presented to the Sentara Northern Virginia Medical Center emergency department with "headache since yesterday, progressing to lower and upper extremity stiffness . . . ." Pet'r's Ex. 5 at 8. Petitioner additionally told the emergency physicians that her menstrual cycle was irregular and her last cycle occurred on October 22, 2012. *Id.* Petitioner was given pain and anti-nausea medication, which improved her symptoms. *Id.* Petitioner's lab tests were unremarkable, and she was discharged home with two days off from work. *Id.*

On January 23, 2013, Petitioner visited Dr. Taffae Cadeau to follow up on her emergency department stay. Pet'r's Ex. 1 at 293. At that time, Petitioner complained of a headache that

[6] Photophobia is the "abnormal visual intolerance of light." *Dorland's Illustrated Medical Dictionary* 1441 (32nd ed. 2012) [hereinafter "*Dorland's*"].

"seemed to radiate down [her] neck and spine." *Id.* Petitioner rated the pain as seven out of ten and also complained of nausea. *Id.* Dr. Cadeau ordered a spinal x-ray, which showed minimal degenerative changes. Pet'r's Ex. 1 at 76–77. Dr. Cadeau prescribed Aleve and referred Petitioner to see a neurologist and a physical therapist. Pet'r's Ex. 1 at 295.

On January 29, 2013, Petitioner visited the Prince William Hospital emergency department complaining of a week-long headache that increased in pain the night before. Pet'r's Ex. 7 at 24–25, ECF No. 7-1. Petitioner was diagnosed with a thoracic and lumbar muscle strain, given pain medication, and discharged that same day. *Id.* at 28–29. On February 22, 2013, Petitioner visited Dr. Marie Wolanin at the Fort Belvoir Community Hospital. Pet'r's Ex. 1 at 284. Petitioner complained of back pain, and Dr. Wolanin wrote that Petitioner awoke seven weeks ago "with a throbbing[,] posterior [headache][,] associated with shooting pain down the midline of her upper back to her mid-back . . . ." *Id.* at 285. She then "developed [a] leg stiffness/tingling feeling." *Id.* Since then, Petitioner "has had continued[,] constant [symptoms] of [headache] [and] back pain." *Id.* Petitioner additionally stated that "she is not able to tolerate wearing a bra or tight pants due to pain." *Id.* Upon examination, Dr. Wolanin noted "[s]ome sensitivity to touch of the skin, hyperalgesia[,][7] and mild allodynia[8] . . . ." *Id.* A spinal x-ray was normal. *Id.* at 287. Dr. Wolanin noted "evidence of autonomic disturbance with skin changes as [Petitioner] has diffuse livedo reticularis,[9] muscle stiffness as well as diffuse hyperesthesia[10] even to light touch." *Id.* Dr. Wolanin noted a differential diagnosis of a complex regional pain syndrome or a viral syndrome and wrote that Petitioner's symptoms were progressing. *Id.* Dr. Wolanin prescribed gabapentin[11] and referred Petitioner to rheumatology. *Id.*

On February 28, 2013, Petitioner saw Dr. Savithri Veluri at the Dumfries Health Center complaining of dizzy spells. Pet'r's Ex. 1 at 274. Dr. Veluri's examination of Petitioner was impeded by her "sensitivity to touch," and Dr. Veluri recommended Petitioner be evaluated for hyperthyroidism. *Id.* at 276. Dr. Veluri diagnosed Petitioner with an autoimmune disease, noting "poly[neuropathy], sensitivity to touch, [arthralgia] in wrists and ankles, dizzy spells, [and] fatigue." *Id.* Petitioner was advised to continue her medications, and Dr. Veluri ordered

[7] Hyperalgesia is an "abnormally increased nociception (pain sense) . . . ." *Dorland's* at 886.
[8] Allodynia consists of "pain resulting from a non-noxious stimulus to normal skin." *Dorland's* at 51.
[9] Livedo reticularis is defined as "a vascular response to any of various disorders . . . . Clinical characteristics include reticular, cyanotic skin surrounding pale central areas on the trunk and limbs, becoming more intense on exposure to cold and often disappearing upon warming." *Dorland's* at 1067.
[10] Hyperesthesia consists of "increased sensitivity, particularly a painful sensation from a normally painless touch stimulus." *Dorland's* at 888.
[11] Gabapentin is the generic version of Neurontin and is "structurally related to the neurotransmitter gamma-aminobutyric acid (GABA) but has no effect on GABA binding, uptake, or degradation." Pfizer, Inc., *Neurontin Medication Guide* 18 (2017), https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/020235s064_020882s047_021129s046lbl.pdf. Neurontin is indicated for the treatment of post-herpetic neuralgia in adults and as adjunctive therapy for partial onset seizures. *Id.* at 1.

labs. *Id.* Petitioner tested positive for anti-nuclear antibodies[12] ("ANA"), and her tests showed abnormal thyroid function. Pet'r's Ex. 1 at 36–42, ECF No. 6-1.

On March 22, 2013, Petitioner underwent a thyroid ultrasound. Pet'r's Ex. 1 at 74. The results showed Petitioner's thyroid to be "very heterogeneous and hypervascular[,] which probably represent[s] [a] thyroiditis such as Hashimoto's."[13] *Id.* On March 26, 2013, Dr. Kate Kinnaird diagnosed Petitioner with thyroiditis. *Id.* at 246. Petitioner continued to suffer from her pain symptoms and complications from thyroiditis through the ensuing months. *See id.* at 99–237. On May 2, 2013, Dr. Kinnaird diagnosed Petitioner with secondary amenorrhea[14] "since Aug[ust] [of] 2012" and suspected possible polycystic ovary syndrome ("PCOS") as a cause. Pet'r's Ex. 1 at 234. On June 18, 2013, Petitioner underwent a pelvic sonograph, which showed an enlarged right ovary. *Id.* at 68. Petitioner was then diagnosed with PCOS[15] on July 4, 2013. Pet'r's Ex. 1 at 198. On July 10, 2013, Petitioner underwent an Electromyography ("EMG") and nerve conduction study that indicated no denervation or compressive neuropathies. Pet'r's Ex. 9 at 7. Petitioner's symptoms continued unabated through the beginning of 2014. *Id.* at 14–15, 161, 163, 167.

On March 26, 2014, Dr. Kinnaird wrote that Petitioner's hyperthyroidism had transitioned to hypothyroidism, and her allodynia symptoms had increased over the past month. *Id.* at 154. On May 22, 2014, Petitioner had an evaluation with rheumatologist Dr. Angelique Collamer. *Id.* at 134. Dr. Collamer recommended a sleep study for possible obstructive sleep apnea ("OSA"). *Id.* at 142. A polysomnogram on June 20, 2014 revealed a mild case of OSA. Pet'r's Ex. 11 at 8, ECF No. 7-5. Petitioner received a continuous positive airway pressure ("CPAP") machine on July 26, 2014 for her OSA symptoms. Pet'r's Ex. 11 at 1, ECF No. 7-5.

On March 19, 2015, Petitioner underwent a neurological evaluation that found that her symptoms could be explained by post-concussive migraines or a small fiber neuropathy. Pet'r's Ex. 13 at 3, 4, ECF No. 7-7. During another neurology consultation on April 13, 2015, Petitioner was referred to undergo testing for autonomic neuropathy. Pet'r's Ex. 1 at 94. An autonomic test on May 1, 2015, revealed orthostatic hypotension.[16] *Id.* at 86.

On July 31, 2015, Petitioner had her initial appointment with neurologist Dr. Carlo Tornatore. Pet'r's Ex. 14 at 3, ECF No. 13-2. Dr. Tornatore noted "profound allodynia" during examination. *Id.* at 3–4. He believed that Petitioner had a peripheral neuropathy "which seems

[12] ANAs are antibodies "directed against nuclear antigens" and are "frequently found in rheumatoid arthritis, scleroderma (systemic sclerosis), Sjögren's syndrome, and mixed connective tissue disease." *Dorland's* at 101.

[13] Hashimoto's thyroiditis is a "progressive type of autoimmune thyroiditis with lymphocytic infiltration of the gland and circulating antithyroid antibodies; patients . . . gradually develop hypothyroidism." *Dorland's* at 534.

[14] Secondary amenorrhea is a "cessation of menstruation after it has once been established at puberty." *Dorland's* at 59.

[15] PCOS is "a clinical symptom complex associated with polycystic ovaries, characterized by oligomenorrhea or amenorrhea, anovulation (hence infertility), and hirsutism." *Dorland's* at 1844.

[16] Orthostatic hypotension is "a fall in blood pressure associated with dizziness, blurred vision, and sometimes syncope, occurring upon standing or when standing motionless in a fixed position; it . . . may occur alone or secondary to a disorder of central nervous system . . . ." *Dorland's* at 906.

to have been precipitated by the immunizations she received on November 10, 2012." *Id.* at 4. Dr. Tornatore ordered tests and would consider a skin biopsy if the tests were "unrevealing." *Id.* A tilt table test on August 27, 2015, was "mildly positive for orthostatic tachycardia,[17] but negative for syncope." Pet'r's Ex. 17 at 6, ECF No. 22-2. A nerve test conducted the next day revealed a non-symptomatic carpal tunnel compression in Petitioner's right wrist, but found "no evidence of widespread polyneuropathy or radiculopathy." *Id.* at 8.

Petitioner returned to Dr. Tornatore for a follow-up on August 31, 2015. Pet'r's Ex. 14 at 1. Dr. Tornatore noted that Petitioner's tests were normal, except for evidence of carpal tunnel compression, and ordered a skin biopsy test to rule out small fiber neuropathy. *Id.* Petitioner underwent this skin biopsy test on September 4, 2015. Pet'r's Ex. 14 at 5. The results were "consistent with a length-dependent neuropathy affecting small nerve fibers." *Id.* The report indicated that "[s]mall fiber neuropathies that are not length-dependent may be more commonly associated with abnormal glucose metabolism or autoimmune disorders." *Id.* at 6.

On October 9, 2015, Petitioner visited Dr. Tornatore to follow up on her skin biopsy. *Id.* at 1. Dr. Tornatore confirmed a diagnosis of small fiber neuropathy and told Petitioner that "this finding documents that her symptoms have a clear peripheral nervous system basis and quite possibly some involvement of the autonomic nervous system giv[en] her postural tachycardia." *Id.* Dr. Tornatore further wrote that it is "highly probable that [Petitioner's] neuropathy is vaccine-induced autoimmune in nature" since "her symptoms came on following the immunizations of November 2012." *Id.* Petitioner and Dr. Tornatore decided to pursue intravenous immunoglobulin[18] ("IVIG") as treatment. *Id.* Petitioner received IVIG treatments through 2018, with limited improvement in her symptoms. *See generally* Pet'r's Exs. 44–45, ECF Nos. 56-2, 56-3.

III. Expert Evidence

Both parties put forward one expert in this case. Petitioner offered Petitioner's treating neurologist, Dr. Carlo Tornatore. Respondent put forward neurologist Dr. Thomas Leist.

a. Expert Reports

i. Petitioner's Expert, Dr. Carlo Tornatore

Dr. Tornatore received his medical degree from Georgetown University School of Medicine in 1986 and became licensed to practice medicine in 1988. Pet'r's Ex. 21 at 1, ECF No. 25-3. Dr. Tornatore is board certified in neurology and is the chair of the Georgetown University School of Medicine Department of Neurology and of the Clinical Department of Neurology for Medstar Georgetown University Hospital. Tr. at 13–14. During the hearing, Dr. Tornatore was admitted without objection as an expert in neurology. *Id.* at 16.

[17] Orthostatic tachycardia is an "excessive rapidity in the action of the heart . . . that occurs when a person rises from a reclining to standing position." *Dorland's* at 1867.

[18] IVIG is the injection of immunoglobulin—"any of the structurally related glycoproteins that function as antibodies"—as a means to treat demyelinating conditions. *Dorland's* at 919.

In his first expert report, Dr. Tornatore opined that "the vaccinations of [November 10, 2012] resulted in an autoimmune response directed towards the small fiber sensory nerves as well as nerves of the autonomic nervous system . . . ." Pet'r's Ex. 20 at 9. Dr. Tornatore wrote that the small fibers of the nervous system "sense pain and itch, innervate internal organs and tissues, and modulate the inflammatory and immune response." *Id.* (citing Pet'r's Ex. 35, ECF No. 53-2, Anne Louise Oaklander, *Immunotherapy Prospects for Painful Small-Fiber Sensory Neuropathies and Ganglionopathies*, 13 Neurotherapeutics 108, 108 (2015)). Symptoms of small fiber neuropathy include "chronic pain and itch, sensory impairment, edema, and skin color, temperature, and sweating changes," along with "cardiovascular, gastrointestinal, and urological symptoms . . . ." *Id.* Dr. Tornatore wrote that skin biopsies must be performed to confirm a diagnosis of small fiber neuropathy, as "[r]outine [e]lectrodiagnostic stud[ies] [do] not detect [small fiber neuropathy] . . . ." *Id.*

Dr. Tornatore indicated that several autoimmune diseases are associated with small fiber neuropathy, including Sjögren's syndrome[19] and celiac disease; however, "some patients with 'idiopathic' [small fiber neuropathy] have evidence of organ-specific dysimmunity, including serological markers." *Id.*

Dr. Tornatore compared the "time course and etiology" of small fiber neuropathy to that of Guillain-Barré syndrome[20] ("GBS"). *Id.* at 10. He stated that both GBS and small fiber neuropathy are "characterized by autonomic and sensory impairment without motor dysfunction that reaches its nadir within a short period of time . . . ." *Id.* He continued that this clinical course "and frequent presence of a history of antecedent infections suggest a participation of immune mechanisms [in both conditions]." *Id.*

Dr. Tornatore argued that vaccines can cause small fiber neuropathy through molecular mimicry. *Id.* Dr. Tornatore wrote that the organic compounds within vaccines can cause an autoimmune reaction "[i]f the antigens present on the vaccine share any homology with host antigens . . . ." *Id.* This cross-reaction leads to an "immune response [that is] directed at both the injection antigens and host antigens, leading to an autoimmune response." *Id.* Dr. Tornatore argued that vaccines for swine flu and tetanus can trigger autoimmune reactions aimed at peripheral nerves. *Id.* (citing Pet'r's Ex. 38, ECF No. 53-5, Lawrence B. Schonberger et al., *Guillain-Barre Syndrome Following Vaccination in the National Influenza Immunization Program, United States, 1976–1977*, 110 Am. J. Epidemiology 105, 105–23 (1979) [hereinafter "Schonberger"]; Pet'r's Ex. 39, ECF No. 53-6, J.D. Pollard & G. Selby, *Relapsing Neuropathy due to Tetanus Toxoid*, 37 J. Neurological Sciences 113, 113–25 (1978)). As further evidence, Dr. Tornatore cited a paper "describ[ing] the onset of small fiber sensory neuropathy following vaccination for rabies, varicella, or Lyme [disease] . . . ." *Id.* (citing Pet'r's Ex. 41, ECF No. 53-8, Nizar Souayah et al., *Small Fiber Neuropathy Following Vaccination for Rabies, Varicella or Lyme Disease*, 27 Vaccine 7322, 7322–25 (2009) [hereinafter "Souayah"]).

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[19] Sjögren's syndrome is "a symptom complex of unknown etiology, . . . marked by the triad of keratoconjunctivitis sicca with or without lacrimal gland enlargement, xerostomia with or without salivary gland enlargement, and the presence of a connective tissue disease . . . . An abnormal immune response has been implicated." *Dorland's* at 1848.

[20] GBS is a "rapidly progressing ascending motor neuron paralysis of unknown etiology, frequently seen after an enteric or respiratory infection." *Dorland's* at 1832.

Finally, Dr. Tornatore wrote that the onset of new pain symptoms Petitioner experienced on January 17, 2013, constitutes a reasonable temporal relationship to her vaccinations. *Id.* Dr. Tornatore argued that Schonberger provides evidence that the swine flu vaccine was associated with an increased risk of developing an inflammatory neuropathy anywhere from five to ten weeks following vaccination. *Id.* (citing Schonberger at 111–12). Petitioner's symptoms began within a ten-week time frame, which Dr. Tornatore considered to be "a plausible period for the initiation of an immune response following vaccination." *Id.* at 10–11.

ii. Respondent's Expert, Dr. Thomas Leist

Dr. Leist received a doctorate in biochemistry from the University of Zurich in 1985 and a medical degree in 1993 from the University of Miami. Resp't's Ex. B at 1, ECF No. 30-2. He is currently a Professor of Neurology at Thomas Jefferson University and the Director of the Comprehensive Multiple Sclerosis Center. *Id.* He also runs "a clinical service . . . concerned [with] neurological consequences of autoimmune diseases." Tr. at 65. Dr. Leist has treated small fiber neuropathy patients as part of his clinical duties. *Id.* at 67. During the hearing, Dr. Leist was admitted without objection as an expert in neuroimmunology. *Id.*

Dr. Leist challenged Dr. Tornatore's opinion by arguing two main points: Petitioner suffered from autonomic dysfunction prior to her vaccination, and she did not experience any adverse symptoms to the vaccine within a reasonable time frame. Resp't's Ex. A at 7, ECF No. 30-1.

Dr. Leist emphasized Petitioner's "extensive headache and pain history" in arguing that Petitioner may have suffered from autonomic nervous system dysfunction and neuropathy prior to her vaccination. *Id.* He highlighted Petitioner's syncope in September of 2009 and subsequent complaints of fatigue, dizziness, pain, weakness, headache, and nausea. *Id.* at 8. Dr. Leist also noted Petitioner's request to be exempt from wearing goggles in chemistry lab class because "they put too much pressure on her head [and caused] excruciating pain, . . ." *Id.* Dr. Leist recounted that Petitioner had irregular menses "from at least 2009" and that her PCOS began in August of 2012. *Id.* at 9. Her eventual autoimmune thyroiditis and sleep apnea diagnoses provide additional evidence that Petitioner's autonomic dysfunction was not vaccine-related. Dr. Leist relied on Oakland and Klein's finding of a "significantly increased" incidence of autoimmune thyroiditis and sleep apnea in patients with PCOS. *Id.* Furthermore, they reported small fiber polyneuropathy comorbidity with PCOS and autoimmune thyroiditis, but "[a]n association with recent immunizations was not reported." *Id.* Dr. Leist emphasized that it is not known whether the neuropathy in [Petitioner's] case is autoimmune in nature. *Id.* at 8. He noted that Petitioner's neuropathy is length dependent, whereas studies have found that "small fiber neuropathies *that are not length dependent* may be more commonly associated with abnormal glucose metabolism autoimmune disorders." *Id.* at 9. (emphasis added).

Dr. Leist challenged Dr. Tornatore's use of the Schonberger article to argue that Petitioner experienced an onset of symptoms within a reasonable time frame. *Id.* at 9. Dr. Leist wrote that the epidemiological data used in the Schonberger article was re-examined by Langmuir et al. *Id.* (citing Resp't's Ex. D, ECF No. 30-4, Alexander D. Langmuir et al., *An*

Epidemiologic and Clinical Evaluation of Guillain-Barré Syndrome Reported in Association with the Administration of Swine Influenza Vaccines, 119 J. Epidemiology 841 (1984) [hereinafter "Langmuir"]). This later analysis "describe[d] a [six-]week window during which the risk [of developing GBS] with the then[-]used [flu] vaccine was elevated compared to controls." *Id.* Dr. Tornatore placed the onset of Petitioner's condition on January 17, 2013, which is "more than sixty days" following her vaccination. *Id.* Dr. Leist argued that this date of onset far exceeded the forty-two day window found in Langmuir and is therefore unreasonable. *Id.*

Even though Dr. Leist used Langmuir to critique Dr. Tornatore's time frame, Dr. Leist also argued that the comparison of small fiber neuropathy to GBS is improper. "[GBS] is distinct from small fiber neuropathy[,] and current influenza vaccine preparations in use are distinct from those used in 1976 [and 1977]." *Id.* Furthermore, Dr. Leist emphasized that small fiber neuropathy has never been associated with vaccines. *Id.* A report from the Institute of Medicine found evidence "regarding an association between varicella vaccine and small fiber neuropathy as lacking." *Id.* (citing Resp't's Ex. J, ECF No. 54-3, Inst. Med., *Adverse Effects of Vaccines: Evidence and Causality* 274–75 (2012) [hereinafter "IOM"]). Another study cited by Dr. Leist found no association with recent immunizations in a review of 41 cases of small fiber neuropathy "in unexplained, juvenile[-]onset, widespread pain syndromes." *Id.* (citing Resp't's Ex. E, ECF No. 30-5, Anne Louise Oaklander & Max M. Klein, *Evidence of Small-Fiber Neuropathy in Unexplained, Juvenile-Onset, Widespread Pain Syndromes*, 131 Pediatrics 1091, 1091–98 (2013)). By contrast, PCOS was found in four of these cases, and autoimmune thyroiditis was found in six cases. *Id.*

iii. Dr. Tornatore's Second Supplemental Report

In his second supplemental report, Dr. Tornatore provided specific responses to three of Dr. Leist's points. Pet'r's Ex. 23. Dr. Tornatore first addressed Dr. Leist's contention that Petitioner suffered from autonomic dysfunction prior to her vaccination. *Id.* at 2. Dr. Tornatore argued that the only evidence Dr. Leist uses for his claim is "a single syncopal episode [Petitioner] had [in] September [of] 2009 as well as [her] complaints of headache, nausea[,] and dizziness [in] April [of] 2010." *Id.* Dr. Tornatore posited that Petitioner's syncopal episode in September "occurred while at work and never recurred," and Petitioner's other symptoms were due to her previous concussions. *Id.* Dr. Tornatore wrote that even if Petitioner had any autonomic insufficiency before 2012, "there clearly was a marked change following the vaccination[s,] i.e.[,] there was a significant aggravation of an underlying disorder . . . ." *Id.*

Second, Dr. Tornatore summarized that Dr. Leist used the IOM report "as evidence that vaccines have not been associated with small fiber neuropathy." *Id.* Dr. Tornatore responded that "[i]t is a central tenet of epistemology[] that a rare event cannot be ruled out using epidemiological evidence." *Id.* Instead, Dr. Tornatore wrote that "[b]iological plausibility offers us a way to understand these rare events which may not rise to the level of statistical significance." *Id.* He argued that he offered a biologically plausible causation theory in his previous report that explains the rare event of Petitioner's injury. *Id.*

Finally, Dr. Tornatore addressed Dr. Leist's argument that the onset of Petitioner's injury occurred outside a reasonable time frame. *Id.* Dr. Tornatore argued that the application of epidemiological risk intervals to individual cases is fraught "due to our incomplete knowledge on the pathophysiology of many adverse events. Due to this uncertainty, a longer risk interval may be required when evaluating an adverse event following immunization in an individual patient." *Id.* (citing Pet'r's Ex. 43, ECF No. 53-10, Ali Rowhani-Rahbar et al., *Biologically Plausible and Evidence-Based Risk Intervals in Immunization Safety Research*, 31 Vaccine 271 (2012) [hereinafter "Rowhani"]).

b. Expert Testimony

i. Dr. Tornatore

Dr. Tornatore began his testimony by recounting Petitioner's medical history, including his time treating Petitioner for small fiber neuropathy. Tr. at 16–26. Dr. Tornatore stated that his "working assumption" was that Petitioner's condition was autoimmune in nature, "particularly because it came on probably via vaccination." *Id.* at 26. Dr. Tornatore explained that one factor for this assumption was that Petitioner's illness resembled GBS in its course. *Id.* A second factor was that GBS can affect the autonomic nerves, causing autonomic dysfunction. *Id.* at 28. These indicia led Dr. Tornatore to compare Petitioner's illness to a post-vaccinal condition similar to GBS. *Id.* He conceded, though, that attempts to treat Petitioner via IVIG had "not been terrific." *Id.* at 27.

Dr. Tornatore reiterated his theory that a vaccine could cause such a response due to molecular mimicry. *Id.* at 29. Dr. Tornatore opined that the influenza and varicella vaccines "were the leading combination" to cause an autoimmune reaction due to previous studies showing an association between these vaccines and autoimmune conditions. *Id.* at 37–38. Dr. Tornatore argued that there does not have to be a specific homology to cause molecular mimicry due to "degeneracy," wherein an immune response to a given antigen causes an "immune response [that] target[s] multiple other sites that . . . bear very little resemblance to the . . . original stimulated antigen." *Id.* at 39.

Dr. Tornatore cited case studies of small fiber neuropathy following rabies, varicella, and Lyme disease vaccinations and specifically highlighted one "almost identical" case to Petitioner's. *Id.* at 29–30. In Souayah, the authors detail the case history of a woman who developed dysesthesia two weeks following a varicella vaccination. *Id.* Dr. Tornatore opined that the timing and description are very similar to Petitioner's case and highlighted the case study's neurological exam results as "very similar" to Petitioner's. *Id.* at 30. Dr. Tornatore stated that although we do not have "enough literature on onset of small fiber neuropathy," the timing of onset of GBS can "inform our thinking" because it is also an "autoimmune neuropathy . . . ." *Id.* at 31.

Dr. Tornatore then reiterated his argument that Schonberger provides evidence that GBS can occur within a "biologically plausible time frame" of twelve weeks after vaccination because "there is a potential for inflammation to occur at the peripheral nervous system site out to 10 to 12 weeks." *Id.* at 31–32, 35–36. Dr. Tornatore opined that the relevant literature can "tell us

what the incidence is, but it does not tell us what the outside borders are of that potential disease state." *Id.* at 35. Dr. Tornatore cited Rowhani's catchall statement that epidemiological risk intervals cannot be definitively applied to individual cases because of the circumstances of each patient. *Id.* at 34–35. He concluded that "from a[n] immunologic standpoint" he has articulated "an acceptable thesis to put forward, as long as there is immunologic validity for that." *Id.*

In response to Dr. Leist's contention that Petitioner's autonomic dysfunction began before the vaccination, Dr. Tornatore pointed to blood pressure readings from September 12, 2012. Tr. at 22–23. Dr. Tornatore argued that these readings revealed very little changes in Petitioner's blood pressure when she was standing, compared to lying down or sitting. *Id.* Dr. Tornatore claimed that these results show that she did not have orthostatic hypertension or hypotension prior to her vaccination. *Id.* at 23. Concerning Petitioner's thyroiditis and PCOS, Dr. Tornatore stated it is true "[Petitioner] had [these conditions] prior to the vaccination[;] however, [Petitioner] did not have the dysesthesia and the . . . profound sensory symptoms until . . . after the vaccination." *Id.* at 41–42. Dr. Tornatore argued that if Petitioner's thyroiditis and PCOS were indicative of an underlying neuropathy, the vaccines caused a significant aggravation of that condition; "however," Dr. Tornatore continued, "[there is nothing] in the medical literature that says [Petitioner] had a small fiber neuropathy until after the vaccination." *Id.*

Upon cross-examination, Dr. Tornatore agreed that the nerve conduction studies performed on Petitioner showed normal results, indicating that she did not have a large fiber neuropathy. *Id.* at 48. The undersigned asked Dr. Tornatore to further explain why he was specifically comparing small fiber neuropathy to GBS. *Id.* at 54. Dr. Tornatore answered that there are two reasons for his comparison. *Id.* First, Dr. Tornatore said that the timing of the two diseases is comparable, given "the tempo of an immune response against the nervous system . . . ." *Id.* Second, Dr. Tornatore stated that both GBS and small fiber neuropathy can affect the autonomic nervous system. *Id.*

The undersigned asked whether "the main focus of [his] assessment about whether or not [Petitioner's condition] was vaccine-induced would be largely the temporal relationship[,]" to which Dr. Tornatore responded, "[a]nd the change in her symptoms." *Id.* at 58. Dr. Tornatore also stated that Petitioner did not see a negative reaction to previous flu vaccines, "[b]ut . . . the memory part of the immune system will come back quicker [with subsequent vaccinations], and it may then cause that spillover and cause . . . molecular mimicry." *Id.* at 58–59. The undersigned asked whether Dr. Tornatore was "suggesting that . . . [Petitioner] had this susceptibility[,] and the vaccine . . . pushed her over the edge," to which Dr. Tornatore replied, "[e]xactly." *Id.* at 63.

ii. Dr. Leist

Dr. Leist began his testimony stating that he had treated patients with small fiber neuropathy in the past. Tr. at 65–67. Dr. Leist explained that small fiber neuropathy "can occur for many different reasons," but an "autoimmune-caused small fiber neuropathy would . . . be a minority or . . . an exception to . . . why individuals have small fiber neuropathy." *Id.* at 71. Dr. Leist opined that there is no indication that Petitioner's small fiber neuropathy is autoimmune in

nature. *Id.* at 81. The lack of improvement using IVIG and the comments to the test that revealed Petitioner's small fiber neuropathy both do not indicate an autoimmune etiology to Dr. Leist. *Id.* at 81. Dr. Leist stated that small fiber neuropathy most commonly occurs "later in life[] because of conditions" such as diabetes. *Id.* Dr. Leist continued that the Oaklander study found that small fiber neuropathy which begins early in life was associated with widespread pain syndrome ("WPS"). *Id.* at 72 (citing Resp't's Ex. E). The patients with WPS "had significant headache symptoms," and "a number . . . actually had polycystic ovarian syndrome . . . and . . . autoimmune thyroid disease." *Id.* Dr. Leist stated that WPS and what Petitioner's treating physicians labeled allodynia may be synonymous. *Id.* at 73. Dr. Leist also highlighted that chronic headaches were observed across the patient population in Oaklander. *Id.*

Dr. Leist reiterated his argument that Petitioner experienced symptoms consistent with small fiber neuropathy prior to her vaccinations. *Id.* at 74–75. Dr. Leist also addressed the blood pressure results that Dr. Tornatore discussed in his testimony. *Id.* Dr. Leist noted that Petitioner had a "significantly higher" heart rate when she was standing, and her heart rate "significantly dropped when she was lying down . . . ." *Id.* This evidence indicated "some element of orthostatic manifestation" to Dr. Leist. *Id.* Dr. Leist then noted Petitioner's chronic headache and "significant gastrointestinal symptoms" in August of 2010 as further evidence of a possible "autonomic condition that affects the gastrointestinal tract." *Id.* at 76.

Dr. Leist provided some examples within Petitioner's medical history that he identified as evidence of pre-existing manifestations of neuropathy. He then turned to Petitioner's post-vaccination records and opined that it was not clear that Petitioner was complaining of symptoms that could be directly related to her neuropathy until she specifically complained of sensitivity to touch in January of 2013. *Id.* at 79. Dr. Leist went further ; "the clearer manifestations that are recorded in the records are actually around February 22, 2013." *Id.* In response to Dr. Tornatore's opinion that there are no pre-vaccination symptoms of Petitioner's small fiber neuropathy, Dr. Leist clarified that he was "aware that Petitioner reported a different chronology of events, but in [his] opinion, [he] relies significantly on the contemporaneous records as they are introduced into the available documentation." *Id.* Dr. Leist also emphasized that Petitioner had no symptoms "directly referable" to the vaccines six days after receiving the vaccines or any symptoms of an "immediate allergic reaction to the vaccines." *Id.* at 74.

Turning to Dr. Tornatore's causation theory, Dr. Leist explained why a comparison between GBS and small fiber neuropathy is inapposite. *Id.* at 83–84. The first is a difference of pathology. *Id.* at 83. There are many other causes to small fiber neuropathy besides an autoimmune reaction, including diabetes and heavy metal toxicity. *Id.* at 83–84. Dr. Leist continued that if both are presumed to occur due to molecular mimicry, as espoused by Dr. Tornatore, there is no evidence as to what antigen in the vaccines could cause small fiber neuropathy. *Id.* at 84–85. Dr. Leist continued that beyond a temporal association, there is no connection in the medical literature between small fiber neuropathy and vaccines. *Id.* at 85.

Dr. Leist also reiterated his argument that the time frame put forward by Dr. Tornatore is unreasonable. *Id.* at 93. He argued that the Rowhani article upon which Dr. Tornatore relied to argue against risk intervals is inapposite and explained that the section cited by Dr. Tornatore is

actually discussing whether the authors should rely upon a twenty-eight day or forty-two day interval for a different demyelinating disease. *Id.* at 98–99.

Upon cross-examination, Dr. Leist conceded that WPS and allodynia are not interchangeable. *Id.* at 111. WPS "may contain allodynia, but may contain additional symptomology." *Id.* Dr. Leist initially stated that Petitioner first manifested this condition when she requested not to wear goggles in lab class. *Id.* at 112. Petitioner's counsel then depicted this request as a way not to irritate Petitioner's previous head injuries, and Dr. Leist replied he could not rule out this explanation. *Id.* at 112–13. Dr. Leist opined that, simply because someone may have autoimmune conditions like polycystic ovarian syndrome and thyroiditis, it does not necessarily mean that she will develop autoimmune small fiber neuropathy. *Id.* at 118. He maintained that although these conditions are associated, "the exact nature of the [small fiber neuropathy] is something that would have to be first worked out." *Id.* Dr. Leist agreed that molecular mimicry could lead to an autoimmune small fiber neuropathy, but "you don't have anything to back up the theory." *Id.* at 120. Dr. Leist did not know whether Petitioner's pre-existing autoimmune disorders made her more susceptible to incurring a vaccine reaction. *Id.* at 135.

The undersigned asked Dr. Leist whether molecular mimicry could be a plausible mechanism for the development of small fiber neuropathy. *Id.* at 136. Dr. Leist answered that "[a]s a theoretical construct, [it] would be possible." *Id.* Dr. Leist also stated that autoantibodies, T cells, and molecular mimicry could contribute to small fiber neuropathy "individually or in conflagration." *Id.* at 138. Dr. Leist then reiterated that Petitioner's pre-vaccine gastrointestinal symptoms "could be a manifestation of dysautonomia." *Id.* at 139–40.

Upon re-cross examination, Petitioner's counsel asked Dr. Leist questions concerning Petitioner's pre-vaccination gastrointestinal complaints of August of 2010. *Id.* at 145. Dr. Leist conceded that although Petitioner was diagnosed with possible irritable bowel syndrome at that time, there was no mention of the condition later in the medical records. *Id.* at 146–47.

IV. The Applicable Legal Standard

To receive compensation under the Vaccine Act, Petitioner must demonstrate either that: (1) Petitioner suffered a "Table injury" by receiving a covered vaccine and subsequently developing a listed injury within the time frame prescribed by the Vaccine Injury Table set forth at § 14, as amended by 42 C.F.R. § 100.3; or (2) that she suffered an "off-Table Injury," one not listed on the Table, as a result of her receipt of a covered vaccine. *See* § 11(c)(1)(C); *Moberly v. Sec'y of Health & Human Servs.*, 592 F.3d 1315, 1321 (Fed. Cir. 2010); *Capizzano v. Sec'y of Health & Human Servs.*, 440 F.3d 1317, 1320 (Fed. Cir. 2006). Petitioner's claim that her TDaP, Varicella, Meningococcal, and flu vaccines caused her to develop small fiber neuropathy does not fall within the Vaccine Table. Thus, she must prove that her injury was caused-in-fact by one or more of these vaccines.

To establish causation-in-fact, Petitioner must demonstrate by a preponderance of the evidence that the vaccine was the cause of the injury. § 13(a)(1)(A). Petitioner is required to prove that the vaccine was "not only [the] but-for cause of the injury but also a substantial factor

in bringing about the injury." *Moberly*, 592 F.3d at 1321–22 (quoting *Shyface v. Sec'y of Health & Human Servs.*, 165 F.3d 1344, 1352–53 (Fed. Cir. 1999)).

In *Althen v. Secretary of the Department of Health and Human Services*, the Federal Circuit set forth a three-pronged test to determine whether a petitioner has established a causal link between a vaccine and the claimed injury. 418 F.3d 1274, 1278–79 (Fed. Cir. 2005). The *Althen* test requires the petitioner to set forth: "(1) a medical theory causally connecting the vaccination and the injury; (2) a logical sequence of cause and effect showing that the vaccination was the reason for the injury; and (3) a showing of a proximate temporal relationship between vaccination and injury." *Id.* To establish entitlement to compensation under the Program, a petitioner is required to establish each of the three prongs of *Althen* by a preponderance of the evidence. *See id.*

Specifically, under the first prong of *Althen*, a petitioner must offer a scientific or medical theory that answers in the affirmative the question "can [the] vaccine(s) at issue cause the type of injury alleged?" *See Pafford v. Sec'y of Health & Human Servs.*, No. 01-0165V, 2004 WL 1717359, at *16 (Fed. Cl. Spec. Mstr. July 16, 2004), *mot. for rev. denied*, 64 Fed. Cl. 19 (2005), *aff'd*, 451 F.3d 1352 (Fed. Cir. 2006). This may be accomplished in a number of ways. "Reliability and plausibility of [] pathogenesis can be bolstered by providing evidence that at least a sufficient minority in the medical community has accepted the theory, so as to render it credible." *Id.* at *16–17. In addition, "epidemiological studies and an expert's experience are not dispositive, but lend credence to a claim of plausibility." *Id.* at *17. Medical literature published in respected medical journals is also persuasive. *Id.* "However, publication 'does not necessarily correlate with reliability,' because 'in some instances well-grounded but innovative theories will not have been published.'" *Id.* (quoting *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 593–94 (1993)).

In addition to showing that the vaccine at issue can cause a particular injury, a petitioner must also, under *Althen's* second prong, prove that the vaccine actually did cause the alleged injury in a particular case. *See Pafford*, 2004 WL 1717359, at *16; *Althen*, 418 F.3d at 1279. A petitioner does not meet this obligation by showing only a temporal association between the vaccination and the injury; the petitioner must explain "how and why the injury occurred." *Pafford*, 2004 WL 1717359, at *16.

Although a temporal association alone is insufficient to establish causation, under the third prong of *Althen*, a petitioner must show that the timing of the injury fits with the causal theory. *See Althen*, 418 F.3d at 1278. The special master cannot infer causation from temporal proximity alone. *Grant v. Sec'y of Health & Human Servs.*, 956 F.2d 1144, 1148 (Fed. Cir. 1992) ("The inoculation is not the cause of every event that occurs within the ten[-]day period . . . . Without more, this proximate temporal relationship will not support a finding of causation." (quoting *Hasler v. United States*, 718 F.2d 202, 205 (6th Cir. 1983))).

A petitioner who demonstrates by a preponderance of the evidence that she suffered an injury caused by vaccination is entitled to compensation, unless Respondent can demonstrate by a preponderance of the evidence that the injury was caused by factors unrelated to the vaccination. *See Althen*, 418 F.3d at 1278; *Paluck v. Sec'y of Health & Human Servs.*, 786 F.3d

1373, 1386 (Fed. Cir. 2015) (citing *de Bazan v. Sec'y of Health & Human Servs.*, 539 F.3d 1347, 1352 (Fed. Cir. 2008) (holding that it is not a petitioner's burden "to rule out every other potential cause of his injury")); *Knudsen v. Sec'y of Health & Human Servs.*, 35 F.3d 543, 547 (Fed. Cir. 1994).

Finally, a petitioner may be entitled to compensation if said petitioner can demonstrate that a covered vaccine or vaccines significantly aggravated a pre-existing condition. The Vaccine Act defines significant aggravation as "any change for the worse in a preexisting condition which results in markedly greater disability, pain, or illness accompanied by substantial deterioration of health." § 300aa-33(4).

In *Loving v. Sec'y of Health & Human Servs.*, 86 Fed. Cl. 135, 144 (2009), the United States Court of Federal Claims established the governing six-part test for *off-Table* significant aggravations. Petitioner must prove by a preponderance of the evidence:

> (1) The person's condition prior to administration of the vaccine, (2) the person's current condition (or the condition following the vaccination if that is also pertinent), (3) whether the person's current condition constitutes a 'significant aggravation' of the person's condition prior to vaccination, (4) a medical theory causally connecting such a significant worsened condition to the vaccination, (5) a logical sequence of cause and effect showing that the vaccination was the reason for the significant aggravation, and (6) a showing of a proximate temporal relationship between the vaccination and the significant aggravation.

Id. The Federal Circuit endorsed this test in *W.C. v. Sec'y of Health & Human Servs.*, 704 F.3d 1352, 1357 (Fed. Cir. 2013).

The first three *Loving* prongs were first formulated as a test for *Table* significant aggravation claims. *Whitecotton v. Sec'y of Health & Human Servs.*, 81 F.3d 1099 (Fed. Cir. 1996). In *Whitecotton*, the Federal Circuit cited legislative history regarding what constitutes a significant aggravation: "This provision does not include compensation for conditions which might legitimately be described as pre-existing (e.g., a child with monthly seizures who, after vaccination, has seizures every three and a half weeks), but is meant to encompass serious deterioration (e.g., a child with monthly seizures who, after vaccination, has seizures on a daily basis)." *Id.* at 1102–03 (citing H.R. Rep. 908, 99th Cong. 2d Sess. 1, *reprinted in* 1968 USCCAN 6287, 6356). In *W.C.*, the Federal Circuit held that the same inquiry applies when evaluating whether a petitioner suffered a significant aggravation of an *off-Table* injury. 704 F.3d at 1356–57. However, petitioner has the burden of establishing each prong, including that her current condition constitutes a significant aggravation. *Id.* The Federal Circuit did not elaborate on the petitioner's burden, i.e., whether she must establish that her condition would not have progressed to the same extent in the absence of the vaccine *or* under which *Loving* prong that burden would fit.

Loving prongs four, five, and six are derived from *Althen's* prongs one, two, and three respectively. *Loving*, 86 Fed. Cl. at 144.

In determining whether a petitioner is entitled to compensation, a special master must consider the entire record and is not bound by any particular piece of evidence. § 13(b)(1) (stating that a special master is not bound by any "diagnosis, conclusion, judgment, test result, report, or summary" contained in the record). Furthermore, a petitioner is not required to present medical literature or epidemiological evidence to establish any *Althen* prong. *Grant*, 956 F.2d at 1149; *Andreu v. Sec'y Health & Human Servs.*, 569 F.3d 1367, 1380 (Fed. Cir. 2009). The special master essentially must weigh and evaluate opposing evidence in deciding whether a petitioner has met her burden of proof.

Once a petitioner fulfills the six *Loving* prongs, the burden of persuasion shifts to respondent to show that the alleged injury was caused by a factor unrelated to the vaccination. *Knudsen*, 35 F.3d at 548; § 13(a)(1)(B). Respondent has the burden of demonstrating that "a factor unrelated to the vaccination is the more likely or principal cause of the injury alleged. Such a showing establishes that the factor unrelated, not the vaccination, was 'principally responsible' for the injury." *Deribeaux v. Sec'y of Health & Human Servs.,* 717 F.3d 1363, 1369 (Fed. Cir. 2013). Section 13(a)(2) specifies that factors unrelated "[do]not include any idiopathic, unexplained, unknown, hypothetical, or undocumented causal factor, injury, illness, or condition." 42 U.S.C. § 300aa–13(a)(2). Close calls regarding causation must be resolved in favor of the petitioner. *Althen*, 418 F.3d at 1280; *Knudsen*, 35 F.3d at 551 ("If the evidence (on alternative cause) is seen in equipoise, then the government has failed in its burden of persuasion and compensation must be awarded.").

V. DISCUSSION

a. *Althen* Prong One

Dr. Tornatore, argued that Petitioner suffered small fiber neuropathy as a result of an autoimmune response triggered by several vaccinations administered on November 10, 2012. He identified molecular mimicry as the mechanism and relied on a sequence of cause and effect that has been successfully advanced in cases involving the flu vaccine and GBS to explain what happened in Petitioner's case.[21] Dr. Tornatore characterized small fiber neuropathy as a "kissing cousin for GBS" and explained that "they are more alike . . . in both their clinical characteristics, but also from the immunologic standpoint as well." Tr. at 55. When questioned further, Dr. Tornatore explained that "whether it's motor sensory fibers or whether it's the small myelinated or unmyelinated fibers, the response, the rate of the response when we involve molecular mimicries or hypothesis, are going to be the same." Tr. at 54. He continued that GBS "can have an autonomic component to it, it can have a small . . . and large fiber component to it, because the response is not only against demyelinated nerves with GBS." Tr. at 55. Although Dr. Tornatore did not have medical literature to support his contention that GBS and small fiber neuropathy are sufficiently related to justify such an analogy, "even where the claim is not supported with conclusive medical literature, epidemiological studies, and/or theories enjoying general acceptance in the scientific or medical communities," a petitioner may meet her burden of proof through other evidence. *Barone v. Sec'y of Health & Human Servs.*, 2014 WL 6834557 at *7 (citing *Andreu*, 569 F.3d at 1378). As in *Barone*, Respondent's expert here reluctantly

[21] Vaccine-caused GBS is recognized in the Program and presumed in cases with an appropriate diagnosis, temporal relationship, and other conditions. 42 C.F.R. § 100.3(a)(XIV)(D).

admitted that "as a theoretical construct, it would be possible" for molecular mimicry to cause small fiber neuropathy as a result of a vaccination. *Id.*; Tr. at 136.

Despite his concession, Dr. Leist maintained that "a conclusion that if GBS can occur, small fiber neuropathy can occur, [is] not a conclusion that I would agree with." Tr. at 85. Dr. Leist noted the lack of medical literature or case studies to support Dr. Tornatore's conclusion, but he did not provide rebuttal to the premise that vaccine-caused small fiber neuropathy could occur in the rarest of circumstances. Instead, Dr. Leist stated that the one case study Petitioner was able to obtain did not provide any "more information than a temporal relationship to ascertain a causation." *Id.* Vaccine-related injuries are, by their very nature, rare occurrences. It is precisely because of this that the overwhelming consensus within the medical profession is to promote vaccination. To dismiss a causation theory that Respondent's own expert describes as possible because so few people are affected would undercut the Program's premise that the government promote vaccination because the small risk of injury is outweighed by the many health benefits received. Dr. Tornatore has provided a causation theory that while not yet borne out in the literature, meets the preponderant standard to establish that the vaccines at issue can cause the injury alleged. Dr. Leist was unable to rebut the theory with a methodologically fatal flaw. Petitioner has therefore met her burden with respect to prong one and set forth a causation theory causally connecting the vaccines at issue and the injury described.

b. *Althen* Prong Two

Although Dr. Tornatore identified a causation theory that satisfies the first prong of *Althen*, his application of the theory to Petitioner's condition was not as successful. Dr. Tornatore served as medical expert and treating specialist for Petitioner in this case; therefore, his diagnosis and treatment of Petitioner's injury must be considered accordingly. Indeed, a treating physician's notes are usually considered more persuasive than an expert relying solely on the written record. *Capizzano*, 440 F.3d at 1326 (noting that "treating physicians are likely to be in the best position to determine whether a logical sequence of cause and effect show[s] that the vaccination was the reason for the injury." (quoting *Althen*, 418 F.3d at 1280) (internal quotation marks omitted)). Dr. Tornatore was able to examine Petitioner's full medical record and conduct an in-person examination prior to forming an opinion. Furthermore, he is more familiar with vaccine-related injuries than many other treating physicians, and more likely to consider vaccinations as a possible etiology for his patients when applicable.

In this case, Dr. Tornatore's initial visit with Petitioner occurred on July 31, 2015. This would have been approximately two and one-half years after Petitioner's vaccinations. This visit would have also occurred well after both experts agree that Petitioner's relevant symptoms had started to manifest. Both of these facts provide some context for Dr. Tornatore's starting assumption and ultimate conclusion.

Dr. Tornatore testified that his "working assumption was [that Petitioner's condition] was autoimmune in nature, particularly because it came on probably via vaccination." Tr. at 26. It appears that Dr. Tornatore started his review of Petitioner's medical record with his conclusion already in mind. He then worked backward from that perspective to conclude that Petitioner had developed an autoimmune small fiber neuropathy. Her medical history notwithstanding, Petitioner's condition required an autoimmune etiology for Dr. Tornatore's causation theory to

be applicable. This working assumption did not seem to allow for Dr. Tornatore to entertain any other possible cause for Petitioner's condition, and he provided little by way of support for his conclusion. Dr. Tornatore testified that (1) "[Petitioner] was so young, and that she had no other disease." Tr. at 25. He continued that (2) she had suffered a vaccine-based injury based on the "pattern of the onset of her symptoms and her distribution in the peripheral nervous system," and argued that (3) her condition "was very, very, comparable to . . . a post-vaccination [development] of [GBS]." Tr. at 26.

None of the three assertions underscoring Dr. Tornatore's conclusion that Petitioner's small fiber neuropathy was vaccine-caused is supported by the evidence. First, Dr. Tornatore's reliance on Petitioner's youth to conclude that "the vaccination is really the only thing that stands out as the potential trigger" is not found in any treating medical opinion, nor is it pondered in any of the filed medical literature. In fact, the evidence that discusses the development of small fiber neuropathy at a younger age is contemplated in instances where the patient suffers from other autoimmune disorders. Tr. at 58; *see also* Oaklander & Klein, *supra* at 1095. Petitioner's history of two conditions that have a demonstrated comorbidity with small fiber neuropathy also belies Dr. Tornatore's characterization that Petitioner had no other disease. When asked about Petitioner's thyroiditis and PCOS and how they relate to Petitioner's neuropathy, Dr. Tornatore noted that there is "no evidence in the literature" that her medical history increased her risk. Tr. at 62. It noteworthy that Dr. Tornatore maintained that a lack of literature is insignificant when dealing with such rare events as vaccine-related injury, but he criticized Dr. Leist for failing to identify relevant literature to illustrate the relationship between small fiber neuropathy and Petitioner's other conditions. Furthermore, Dr. Tornatore did not rebut the conclusions of the Oaklander study filed by Dr. Leist that specifically discusses a correlation between small fiber neuropathy and PCOS and/or thyroiditis. This article is one of the few pieces of medical literature filed that is applicable to Petitioner's specific circumstances. It does, however, suggest that Petitioner may be susceptible to autoimmune dysfunction.

When asked about an autoimmune etiology for Petitioner's small fiber neuropathy, Dr. Leist did not adequately explain why he concluded that Petitioner's history of autoimmune disorders did not make her more susceptible to another autoimmune disease, namely small fiber neuropathy. Although Dr. Leist was unable to respond to this possibility, he provided additional evidence that Petitioner's small fiber neuropathy is not autoimmune in nature or caused by the vaccine that will be further discussed in the context of alternative causation.

Dr. Tornatore ultimately acknowledged Petitioner's pre-vaccination history and "that she is [subsequently] at risk for developing other autoimmune diseases." Tr. at 41. He then added, "even if we assume that there was an underlying neuropathy that could be thyroid related prior to the vaccination, clearly the vaccine caused a significant worsening of aggravation of that pre-existing state." *Id.* Dr. Tornatore does not offer any medical evidence or literature that Petitioner's condition, if not caused by the vaccine, was significantly aggravated by the vaccine. Additionally, there is nothing is the record that distinguishes the progression of Petitioner's symptoms as any more or less severe than other cases of unknown etiology. In fact, Dr. Leist reviewed Petitioner's symptom chronology and illustrated how her condition developed beginning with a history of headaches, "general pain conditions," and "significant gastrointestinal symptoms." Tr. at 76. Dr. Tornatore's opinion that Petitioner's dysesthesia is

evidence of significant aggravation is unpersuasive. He does not explain how this symptom developed within the context of his causation theory as opposed to as a part of the natural progression of small fiber neuropathy. He does not compare the development of Petitioner's small fiber neuropathy to how it would have developed absent her vaccinations.

Dr. Tornatore's second point related to the pattern and onset of Petitioner's symptoms. He testified that "after vaccinations people can develop autoimmune neuropathy rather abruptly, something we call Guillain-Barre, but that followed a very similar time course to [Petitioner]." Tr. at 26. However, as noted previously, Petitioner's medical history includes several notations that describe the gradual development of Petitioner's symptoms. Dr. Leist points to symptoms that manifested prior to Petitioner's vaccination to further extend this time period, but even according to Dr. Tornatore's chronology, the symptoms developed over a period of several weeks. Dr. Tornatore then compared Petitioner's pattern of onset of symptoms to a small fiber neuropathy case study of "a [previously] healthy 40-year-old woman who developed a diffused buzzing sensation that progressively attacked her entire body" following the varicella vaccine. Tr. at 29–30. Dr. Tornatore recounted Petitioner's presentation, which revealed that she was twenty years younger than the subject of the case study, that she suffered from other pre-existing conditions that are autoimmune in nature, and that she felt a "hot sensation throughout all four extremities" shortly after her vaccination, followed a month later with allodynia. Tr. at 18. These two cases do not involve patients with similar profiles, medical histories, or symptomology. Furthermore, the paper was careful to note that, unlike the other vaccines discussed therein, the "[v]aricella vaccine is generally safe and effective" with "[f]ew adverse neurologic events, such as GBS . . . reported to the Vaccine Adverse Reporting System." Souayah et al., *supra* at 7324.

Lastly, Dr. Tornatore did not identify what aspects of Petitioner's condition are comparable to a post-vaccination GBS patient, but the filed literature fails to support Dr. Tornatore's point. The Schonberger article is one of two filed by Petitioner that specifically discusses the relationship between GBS and vaccines. That article does not identify any factors that are common in GBS patients and also present in Petitioner's history. In fact, the researchers noted "that a history of chronic disease in general [such as Petitioner's history of autoimmune disorders] was not a very important risk factor in developing GBS." Schonberger, *supra* at 121. Furthermore, the article notes that "most of the differences observed between vaccinated and unvaccinated cases . . . were relatively small" and "[e]vidence that the severity of the disease in both groups was comparable." *Id.* This supports a conclusion that there are few if any distinguishing factors between unvaccinated and vaccinated GBS patients, despite the wide variance in potential outcomes for patients. Furthermore, there was no evidence presented to establish that Petitioner's condition was comparable to one group or the other.

Although Dr. Tornatore does present a causation theory that may, under different circumstances, be applicable to the development of small fiber neuropathy following the series of vaccines that Petitioner received, he did not provide sufficient evidence to establish it more likely than not that is what occurred in Petitioner's case. Petitioner failed to satisfy prong two of *Althen* under the preponderant standard.

c. *Althen* Prong Three

Petitioner's inability to prove that it is more likely than not that her theory is applicable to her specific case is further evidenced by the long temporal relationship between Petitioner's vaccinations and the onset of her symptoms at nine and one-half weeks. Petitioner's time frame is outside the widely accepted onset period for GBS caused by vaccination. Dr. Tornatore cited the Schonberger article and testified that "a reasonable interval probably for any immune vaccine-induced autoimmune injury, probably that 12-week time period, is where the biological probability fits." Tr. at 57. A review of Schonberger however, reveals that the researchers found "[t]he period of increased risk was concentrated primarily within the 5-week period after vaccination, although it lasted approximately 9 or 10 weeks." Schonberger, *supra* at 105. According to Dr. Tornatore's analysis of Petitioner's record, her condition developed ten weeks post-vaccination. Tr. at 31. This would be at the very end of Schonberger's timeframe and is much less persuasive when used by way of analogy to a different condition that purportedly resulted from different vaccines.

Dr. Leist responded directly to Dr. Tornatore's opinion and stated, "I think 42 days has now been accepted." Tr. at 96. Dr. Leist would not extrapolate from the Langmuir study that "supports the earlier conclusion that an association with the date of vaccination persisted for at least six intervals and may have continued at a low level of increased risk as long as eight intervals, but not longer." Resp. Ex. D at 25. He did note, however, that in his opinion, "the Schonberger article [relied on by Dr. Tornatore] has in the past been looked at, has been found wanting, and that the Langmuir article was created – or was offered based on research that was done to correct shortcomings . . . of the Schonberger article." Tr. at 94–95. Dr. Tornatore's chronology places the onset of Petitioner's relevant symptoms at nine and one-half weeks. This is well outside of the eight-week interval described in the Langmuir article. Dr. Tornatore did not respond to Dr. Leist or the Langmuir article, but when asked to set an outer boundary for an appropriate temporal relationship, he stated, "really about 12 weeks is where things start to taper off." Tr. at 57. A 12-week temporal relationship between vaccination and the development of GBS has not been accepted in the Vaccine Program, despite the addition of flu-related GBS cases to the Vaccine Injury Table and successful off-table claims of demyelinating injury occurring up to 8 weeks post-vaccination. 42 C.F.R. § 100.3(a)(XIV)(D). *Brown v. Sec'y of Health & Human Servs.*, 2011 WL 5029865, at *43-44 (Fed. Cl. Spec. Mstr. Sept. 30, 2011). It is even more tenuous to apply such an extended time frame, by way of analogy, to a causation theory involving a different set of vaccines and a different injury. Petitioner has not established by a more likely than not standard that a proximate temporal relationship exists between her vaccinations and her self-described onset of small fiber neuropathy symptoms.

d. Alternative Cause

Because Petitioner did not establish causation pursuant to the preponderant standard, Respondent is under no obligation to demonstrate that Petitioner's injury was caused by alternative factors. Nevertheless, Respondent's expert, Dr. Leist, identified relevant early symptoms in Petitioner's records to support his conclusion that Petitioner suffered from small fiber neuropathy prior to her vaccination. He explained that "Petitioner had conditions that independently could have caused the condition that she has," and noted that he had "introduced

an article that clearly indicates that in the age group in individuals, this condition, small fiber neuropathy, has been observed, independent of vaccination." Tr. at 100. Petitioner's expert did not deny the relationship between Petitioner's other conditions and small fiber neuropathy, but mentioned significant aggravation without any support or further explanation.

Dr. Tornatore was unable to effectively discount Petitioner's history, and hastily noted that "even if we assume that there was an underlying neuropathy that could be thyroid related prior to the vaccination, clearly the vaccine caused a significant worsening or aggravation of that pre-existing state." Tr. at 41. He described a type of "low grade" neuropathy, but did not provide any medical literature, or point to any testimony or medical record to support his argument that the vaccinations caused Petitioner to suffer markedly greater disability, pain or illness. The temporal relationship especially undercuts any argument that vaccinations accelerated the progression of Petitioner's neuropathy. Dr. Tornatore did not explain why the gradual development and progression of symptoms is "of a different quality and caliber than what happened after the vaccination." Tr. at 42. He only provided a conclusion that, by his own admission, began with a working assumption that predated any review of Petitioner's records. Without more, this casual reference to significant aggravation does not meet the standard set out in *Loving* and is inconsistent with the methodology of his causation-in-fact theory. *Loving*, 86 Fed. Cl. at 144.

VI. CONCLUSION

There is no dispute that Petitioner suffers from small fiber neuropathy that was diagnosed after a series of vaccinations. Her claim was brought in good faith, and Petitioner's strength in fighting through her symptoms, particularly during middle to late adolescence, is to be commended. She and her family have endured numerous trials, and there will certainly be additional challenges ahead. However, despite a deep sympathy and empathy for what Petitioner has been through, this decision must not take into account any personal feelings or emotions that these cases often evoke. Instead, it must reflect a thorough analysis of the evidence and a thoughtful balance against the applicable legal standards based upon probative weight and persuasiveness. Petitioner has not established by a preponderance of the evidence that her TDaP, Varicella, Meningococcal, and flu vaccinations caused her small fiber neuropathy. More specifically, she has laid out a plausible causation theory, but has failed to establish that this theory is applicable to her case or that there is a proximate temporal relationship between her vaccinations and injury onset. Therefore, I must **DENY** entitlement in this case.

In the absence of a timely-filed motion for review filed pursuant to Vaccine Rule 23, **the Clerk of Court is directed to ENTER JUDGMENT** consistent with this decision.[22]

IT IS SO ORDERED.

s/Herbrina D. Sanders
Herbrina D. Sanders
Special Master

[22] Pursuant to Vaccine Rule 11(a), entry of judgment is expedited by the parties' joint filing of a notice renouncing the right to seek review.